

## Guiding light between pillars in InP-based photonic crystals

A.A.M. Kok, E.J. Geluk, J.J.G.M. van der Tol, F. Karouta, Y.S. Oei, M.K. Smit  
COBRA Research Institute, Eindhoven University of Technology,  
PO Box 513, 5600 MB Eindhoven, The Netherlands.

Photonic crystals can significantly reduce the size of components in integrated optical circuits. Furthermore, they can add new functionalities to these circuits. In a two-dimensional photonic crystal waveguide, light is confined in-plane by the photonic band gap, and in the third dimension by an index contrast. For a photonic crystal consisting of pillars, which shows a large TM band gap [1], the out-of-plane confinement is weak due to a lack of guiding between the rods.

We aim for fabrication of photonic crystal devices based on pillars of InP with a guiding layer of InGaAsP. Scattering losses due to side wall roughness are reduced by applying a polymer between the pillars [2]. However, this does not solve the problem of the weak out-of-plane confinement. We propose to realize additional guiding between the pillars by implementing a three-layer polymer structure, which will reduce the waveguide losses even more. The index contrast and the thickness of the polymer layers should be matched to those of the pillars.

We present our first technological tests and simulations, showing the feasibility of combining a two-dimensional InP-based photonic crystal of pillars with a three-layer polymer stack to improve the guiding of light.

- [1] J.D. Joannopoulos, R.D. Meade, and J.N. Winn, *Photonic crystals: molding the flow of light* (Princeton university press, Princeton, 1995).
- [2] M. Tokushima, H. Hirohito, and Y. Arakawa, *Appl. Phys. Lett.*, **84**, 21 (2004).